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26.

ON THE POWER OF THE LIVER TO CONVERT URATES INTO UREA.

By SIR LAUDER BRUNTON, M.D., D.Sc., LL.D., F.R.S., and
T. J. BOKENHAM, M.R.C.S.

IN 1860 it was observed by Stockvis (Donders' Archiv, 1860, p. 260), that on warming the alkaline urates with portions of finely divided liver, a large proportion of uric acid disappears and is replaced by urea. From this observation he suggested that the metamorphosis of uric acid into urea is largely carried out by the liver. This suggestion, which was quoted in the earlier physiological text-books, has apparently lately been to some extent forgotten, and it seemed worth while to make a re-investigation of the matter in a fresh series of experiments.

For this purpose the livers of cats which had been recently fed were isolated, and were freed from blood by the artificial circulation, at low pressure, of distilled water. The organs were then minced, the weighed product being next mixed with clean sand and Kieselguhr, and subjected to prolonged trituration by revolving metal blades, in order to thoroughly secure the liberation of intracellular juices. To eliminate the possibility of alteration through rise of temperature, the containing vessel was kept surrounded by a refrigerating mixture.

The juice was next separated by means of strong pressure and mixed with an equal amount of a saturated solution of sodium silicofluoride (to arrest any bacterial action).

Attempts were first made to determine the percentage of (5585)

urea, as such, present in samples of this juice, but the technical difficulties led us to abandon such a plan in favour of its estimation, as nitrogen, by the hypobromite method. Our results were as follows:—

1. A portion was boiled and filtered to get rid of coagulable proteids. Six analyses of the filtrate by the alkaline hypobromite method showed the average amount of urea present to be

0.013 per cent.

2. A second portion of the juice was placed for four hours in an incubator kept at 98° F., being then boiled, filtered, and analysed as before.

The amount of urea found, as the average of six determinations, was

0.018 per cent.

3. A third portion was mixed with potassium urate in proportion of 2 grammes to each 200 c.c. of mixture, subjected to incubation for four hours, then boiled and filtered as in Experiment 2.

The amount of urea found amounted (average of seven determinations) to

0.023 per cent.

These experiments appear to us quite corroborative of the original observations of Stockvis. It seemed also desirable to ascertain the percentage amount of uric acid present in the cellular juice extracted from livers under conditions similar to those established in the preceding set of experiments.

With this object a number of cats' livers, the animals having been recently fed, were isolated and freed from blood by the artificial circulation of normal saline solution under minimal pressure. The organs were then minced, weighed, and after admixture with sand and Kieselguhr subjected to thorough trituration in a mechanical mill, the temperature being kept down by means of a freezing mixture. The juice was then separated by strong pressure and utilised in the following experiments:—

A. A portion was freed by boiling from coagulable proteids. The resulting straw-coloured liquid was then subjected to a quantitative examination by the method devised by Hopkins for determining the contained percentage of uric acid. Two estimations gave the following numbers:—

(1) 0·05 per cent.

(2) 0·048 „

B. A second portion was similarly treated, but previously to being titrated for uric acid it was kept during four hours at a temperature of 98° F. The percentages of uric acid in two estimations were then

(1) 0·051 per cent.

(2) 0·049 „

C. A further portion of the expressed juice was kept for four hours at a temperature of 98° F., after which it was boiled, filtered, and the filtrate titrated as before. The numbers obtained in three estimations were as follows:—

(1) 0·032 per cent.

(2) 0·036 „

(3) 0·035 „

These numbers, after making every allowance for experimental error, appear to show that, in the cellular juice expressed from the livers of cats,—the organs having been first freed from blood—there is present a small percentage of uric acid, and also some enzyme which, unless rendered inactive by heat, is capable under favourable conditions of converting the uric acid present into some other substance.

As a further control, the cellular juice was in like manner obtained from the livers of some cats which had been given no food for some hours. Two series of analyses were made with the following results:—

A. In the boiled juice the percentage of uric acid found was

(1) 0·06 per cent.

(2) 0·061 „

B. In another portion of juice which had been kept for four

hours at a temperature of 98° F., previous to being boiled, the percentage was

- (1) 0·062 per cent.
- (2) 0·061 ,,
- (3) 0·062 ,,

From these results it seems probable that the enzyme capable of decomposing uric acid is present only in the cellular juice obtained from the livers of cats during periods of active digestion.



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